

Development of Electric Underwater Cutting Equipment for Spent Nuclear Fuel Skeletons

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1. Introduction

In order to perform mechanical testing of the support grid, guide tube, and instrumentation tube, it is necessary to cut the spent nuclear fuel skeleton using underwater cutting equipment in the nuclear fuel storage tank at post irradiated examination facility (PIEF). For this purpose, electric cutting equipment was developed by supplementing the disadvantages of the existing hydraulic cutting equipment, which is funded by KAERI. The spent nuclear fuel skeleton was cut using the developed equipment and then, various specimens were collected for the mechanical property testing.

2. Methods and Results

2.1 The existing hydraulic underwater cutting equipment

The existing underwater cutting equipment for spent nuclear fuel skeleton fixes the support grid by operating a clamp using pneumatic pressure. Hydraulic oil to operate an underwater motor is used. This equipment makes repairing difficult in case of failure and hydraulic oil can contaminate the nuclear fuel storage tank. Also, it is difficult to manage the nuclear fuel storage tank in case of hydraulic oil leakage. Separate pneumatic and hydraulic oil equipment is required for operation. Therefore, it is necessary to develop new equipment that complements the problems of existing equipment.

2.2 The development of electric underwater cutting equipment

We have developed electric cutting equipment by supplementing the disadvantages of existing equipment. There are three motors (clamp/rotation/up and down feed) in the upper part of the cutter, and the power is transmitted to the cutting head and clamp in the lower part using gears and long rotating shafts. The two long rotary shafts inside the body allow the cutting stone to rotate and move up and down, and the two long rotary shafts outside the body operate the jig of the clamp to clamp the support grid. After clamping the support grid with the clamp and rotating the cutting stone, the feed shaft is moved to cut the guide guide/instrumentation tube on both sides of the support grid. In addition, hydraulic oil and pneumatic equipment are not required, motors and parts are exposed to the ground for easy

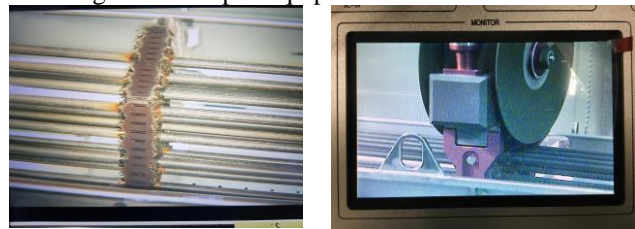
repair in case of failure, and electricity is used to prevent leakage of hydraulic oil from contaminating the nuclear fuel storage tank, and automatic control is possible remotely.



Figure 1. Underwater cutting equipment for spent nuclear fuel skeleton

2.3 Cutting an irradiated 14X14 STD skeleton

The 14X14 STD skeleton, kinds of nuclear fuel, was cut using the developed equipment. The 14X14 STD skeleton was fixed on the underwater skeleton fixing equipment located in PIEF and then the guide/instrumentation tubes at the desired location were cut using the developed equipment.



(a) 14X14 STD skeleton

(b) Cutting of skeleton

Figure 2. Cutting of 14X14 STD skeleton

3. Conclusions

In this study, the electric cutting equipment was developed by supplementing the disadvantages of existing hydraulic equipment. It makes the equipment and tank maintenance easy. The specimens will be utilized to characterize the irradiation performance of spent nuclear fuel structural components through mechanical testing.